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Working Party on the Transport of Dangerous Goods

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Proposals for amendments to annexes A and B of ADR: construction and approval of vehicles

Use of liquefied natural gas (LNG) as fuel for vehicles carrying dangerous goods

Transmitted by the Government of Germany[1]

Summary

Executive summary: At its ninety-sixth session in May 2014, the Working Party adopted amendments to ADR that allow the use of liquefied natural gas (LNG) as fuel for vehicles carrying dangerous goods. These provisions are to enter into force on 1 January 2017.

Belgium, the Netherlands, the United Kingdom, Spain and Portugal have signed "Multilateral Agreement M276 concerning the construction of FL and OX vehicles using liquefied natural gas (LNG) as fuel for their propulsion".

The delegations that had reservations concerning these new provisions were asked to formulate their concerns.

Germany would like to inform the other ADR Contracting Parties of its concerns.

[1] In accordance with the programme of work of the Inland Transport Committee for 2014-2015 (ECE/TRANS/240, para. 100, ECE/TRANS/2014/23, cluster 9, para.9.1).

Action to be taken:	Discussion, examination whether sub-sections 9.2.4.3 and 9.2.4.4 of ADR 2017 need to be revised.
Reference documents:	ECE/TRANS/WP.15/224, paragraphs 31 to 35, ECE/TRANS/WP.15/2014/2 and related informal documents.

Introduction

1. At its ninety-sixth session in May 2014, the Working Party (WP.15) adopted some amendments to facilitate the use of LNG as fuel for FL and OX vehicles. These provisions will come into force on 1 January 2017 and are reproduced in Annex II of the report ECE/TRANS/WP.15/224.

2. It is mentioned in the report (paragraph 32):

> *"Some countries felt that more justification was required before a decision could be taken and that a scientific hazard identification study with regard to the dangerous goods carried should be conducted. The majority of countries, however, agreed that Regulation No. 110 provided a sufficiently high level of safety for the transport of dangerous goods and that the use of LNG as fuel could be allowed."*

3. Germany was one of the countries asking for a study and pointing out its concerns about the sufficiency of ECE Regulation No. 110.

4. Belgium, Netherland, United Kingdom, Spain and Portugal signed Multilateral Agreement "M276 Concerning the construction of FL and OX vehicles using liquefied natural gas (LNG) as fuel for their propulsion".

General position

5. ECE Regulation No. 110 issued by the World Forum for Harmonization of Vehicle Regulations (WP.29) provides sufficient safety for the use of LNG as fuel for passenger cars and normal freight vehicles.

6. However, Germany is of the opinion that there are more aspects which have to be taken into account, if LNG is to be allowed as fuel for special vehicles for the carriage of dangerous goods. This is not the mandate of WP.29, but that of WP.15.

7. Briefly, the points to be considered are in how far the fuel LNG might get into any interaction with the load consisting of dangerous goods not only in normal operations of the vehicle (which are not yet defined) but also in cases of incidents and accidents. This should be done from the perspective of a safe transport of dangerous goods.

Concerns in detail

8. <u>Introduction of new provisions into section 9.2.4 Prevention of fires</u>

Flammability is not the only hazard of LNG. At least the deep cold condition is likewise important.

See also standard *EN 1160:1996 Installations and equipment for liquefied natural gas – General characteristics of liquefied natural gas.*

A more sophisticated research about all hazards of LNG fuel with respect to the possible impacts for the dangerous goods loaded on the vehicle should be performed.

9. New provisions in sub-section 9.2.4.3 Fuel Tank, sub-paragraph (a)

"Normal operating conditions":

From the point of view of the Government of Germany, the insertion "in the normal operating conditions of the vehicle" does not make sense. It is to be assumed that, due to the general technical provisions applicable to motor vehicles, fuel tanks are designed so as to prevent leakage under normal operating conditions. The ADR lays down further requirements that result from the vehicle's special load consisting of dangerous goods. These requirements, here under the heading "Prevention of fire risks", apply particularly to the protection of the load and the limitation the consequences in the case of incidents and accidents.

The activation of a safety valve in the fuel system is not a leakage in the case of a damaged or perforated fuel tank.

"shall not come into contact with hot parts of the vehicle or of the load":

An amendment was made by inserting the word "of":

"shall not come into contact with hot parts of the vehicle or of the load".

It makes a difference, if the fuel shall not come into contact with "the load" (as it reads now) or with "hot parts of the load". Normally a load in a FL, OX or EX vehicle has no "hot parts". On the other hand, the fuel shall not cause the rupture of the containment of the load, i.e. the tank shell or the packages of class 1 goods.

Actively keeping the LNG fuel released during an accident or incident from a leaking fuel tank away from the vehicle or the load is only conceivable for the liquid phase. When LNG is released in normal atmospheric conditions, it quickly turns into a cryogenic gas cloud that cannot be actively kept away from the vehicle.

Main aspects to be considered are:

(a) LNG fuel tanks have a limited specific holding time before the pressure build is relieved, which must be sufficient for the maximum transport time. An operation schedule might be necessary.

(b) A defined scenario usual for incident/accident, with an upright or tilted vehicle.

(c) Effects of deep cold LNG with – 162 °C released from a damaged LNG fuel tank or system towards the tank for the load. As laid down in paragraph 6.8.2.1.8 of ADR these tanks are constructed for a temperature of – 20 °C only. Keywords: spillage, brittle fracture, Joule Thomson Effect.

(d) Have studies been carried out on the compatibility of the load of the different hazard classes that are permitted to be carried in FL, OX and EX vehicles?

(e) Fire of the vehicle (tire fire, fire in the engine), of flammable substance transported in the tank or fire around the vehicle (for example accident of other vehicles) with a release from or a serious damage of the LNG fuel tank.

- Will there be cumulative effects with a load especially, but not only, consisting of flammable or gaseous substances in the tank of the vehicle?

- Shall the emergency response forces be informed about the additional danger, that there is an LNG fuel tank on board the vehicle carrying dangerous goods?
- Is the already established fire fighting equipment (8.1.4 of ADR) sufficient, if the fuel is LNG?

(f) The load in the tank of the vehicle may be for example a corrosive liquid. If released by incident/accident, can the LNG fuel tank withstand this corrosive substance dripping on it or flowing over it? The reaction of the released dangerous goods load with the LNG fuel has to be surveyed.

(g) The load might consist of Class 2 products. Will the LNG fuel system withstand any incident with exploding gas?

(h) With regard to the discharge via or activation of the safety valves of the LNG fuel system, the question of how the discharge is to be controlled to protect the tanks and/or the load is essential. The amendments proposed for the 2017 version do not say anything in this regard. Neither does ECE Regulation No. 110.

- In the case of a potential jetfire, the cargo tank of an AT or OX vehicle or the packages on an EX vehicle might be damaged and the load might be released, catch fire or explode.
- Are the directions/settings in which the discharge is to be directed away from the vehicle and the cargo clearly defined as a standard or design specification for the vehicle?
- How can the operational safety of the safety device be ensured?
- What happens e.g. if the safety valve is jammed or blocked as a result of an accident?

ECE Regulation No. 34:

ECE Regulation No. 34 does not cover LNG as fuel.

See 4.6 of that regulation: *"Liquid fuel" means a fuel which is liquid in normal conditions of temperature and pressure.*

LNG is a cryogenic liquid.

ECE Regulation No. 110:

In ECE Regulation No. 110, according to paragraph 4.11, the LNG system includes the "tanks" and according to paragraph 4.6 "Specific Components" are among others the *"(a) Container (cylinder or tank)", "(b) Accessories fitted to the container"* and *"(j) Filling unit or receptacle"* which are deemed to be parts of the LNG fuel tank. According to paragraph 4.16 a "Container" (or cylinder) means any storage system used for compressed natural gas.

Because of that, a reference to ECE Regulation No. 110 in this subsection dealing with the "Fuel tank" is missing. An argument for this demand is the new transitional provision 1.6.5.17 of ADR, concerning the "LNG fuel system" (see also ECE/TRANS/WP.15/224, annex II).

10. New provisions in sub-section 9.2.4.4 Engine

ECE Regulation No. 110

The engine itself is not part of the *"LNG system"* according to paragraph 4.11 of ECE Regulation No. 110 and not a "*Special component*" according to the list in paragraph 4.6.

Some of the components covered by Regulation No. 110 might be included in the engine "equipment" mentioned indirectly in 9.2.4.4 of ADR. If more detailed technical requirements are specified for this engine equipment, which is more extensive in the case of an LNG fuel system, the heading of the sub-section should be amended, e.g. by adding "and fuel system".

Electronic control unit

The list in paragraph 4.6. of ECE Regulation No. 110 with the title "Specific components" also includes some electronic elements.

It could be clarified whether these elements comply with the requirements in section 9.7.8 (Electrical equipment).